Stimulating mathematical thinking through domino games

Domino games

Most readers would be familiar with the standard domino set which is played with rectangular domino tiles. The domino set, sometimes called a deck or pack, consists of 28 dominoes, colloquially nicknamed bones, cards, tiles, stones, or spinners. A domino set is a generic gaming device, similar to playing cards or dice, in that a variety of games can be played with a set.
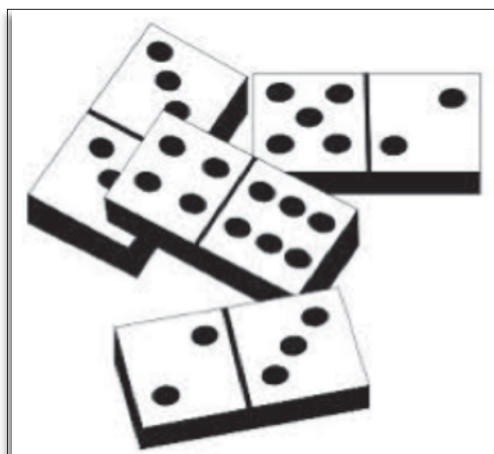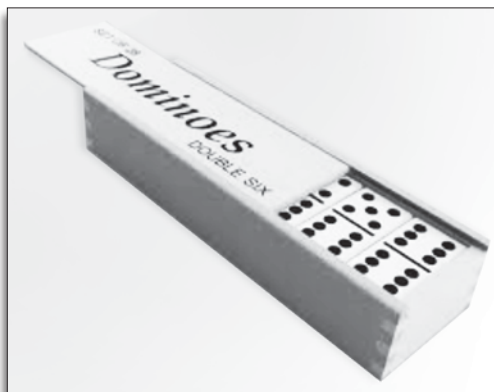

Figure 1. Dominoes.

Dominoes are very simple and basic gaming implements that are so versatile you can play virtually an unlimited number of games with them.

Involving varying degrees of strategy, the only limitation to the games that you play with dominoes is your imagination. There are a huge variety of domino games played all over the world, ranging from the very simple to the extremely complex, from the easy to the incredibly difficult.

Two alternative types of domino sets available include: *Bug Trails,* which is described as a non-standard domino game; and *Bendominoes* which is definitely a game with a twist.

Bug Trails: a non-standard domino game

Bug Trails is a genuinely different domino game. Designed by Brad Ross, and published by ThinkFun (2011), *Bug Trails* supports the teaching of simple strategies and visual matching to younger players. The idea is that each bug (or domino-like piece) is a six-legged tile, with different colours for different legs.

Figure 2. Bug Trails piece.

The usual match-an-end rule applies, with the possibility of matching two or more legs simultaneously (a hint of Triominoes, perhaps). Obviously 'six-legged' dominoes can match in two-dimensional mesh-like ways that are not possible with standard dominoes, which match in a one-dimensional sequence (ignoring the way ordinary dominoes sometimes wiggle around the table to save space).

According to reviews on Amazon.com, *Bug Trails* is easy to play and enjoyable for children, while also engaging adults.
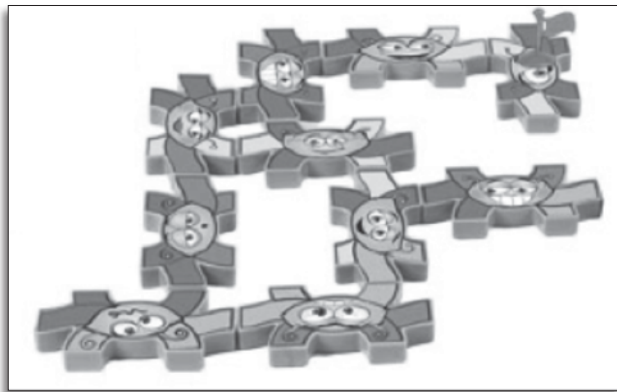

Figure 3. Bug Trails.

There are four joining colours: green, blue, yellow, and orange.

Each piece is loosely equivalent to a hexagon. But using hexagons with whole-edge colouring, would not result in the linear meshing trails of colours that gives this game its name, and its special interest.
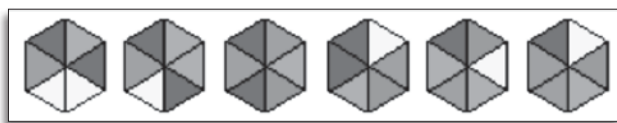

Figure 4. Coloured hexagons.

This raises combinatorial questions about the number of mathematically distinct ways we can colour a hexagon using two, three or four colours. It raises similar questions about the playability of domino-type match-the-edge games using such sets of coloured hexagons.

Geometrically, the specially-shaped *Bug Trails* pieces must join, with gaps, coloured leg matching. That is, the *Bug Trails* pieces can join, but cannot fill the surface—they cannot tessellate! Hexagons could, theoretically, be tessellated to completely fill two-dimensional space. This raises further questions about creating space-filling 2D puzzles using sets of six-triangle hexagons using two, three or four colours.

More precisely, the *Bug Trails* pieces could be treated as an array of nine equal-sized squares, with three non-joinable, neutral coloured squares forming a spine, and six outer legs, each of which can be coloured in one of four ways.
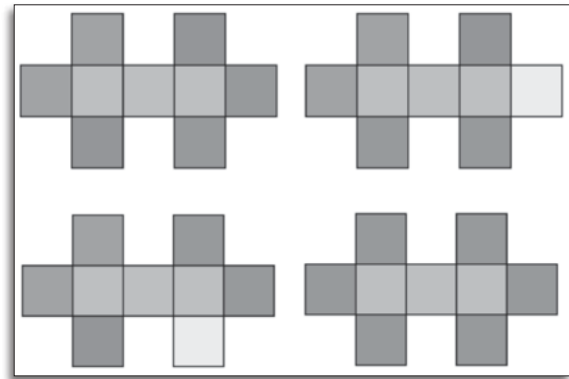
For example:

Figure 5. Arrays of nine equal size squares.

Similarly, this raises combinatorial questions about the number of mathematically distinct ways we can colour a *Bug Trails* piece using two, three or four colours. It seems unlikely that the set of pieces used to play Bug Trails contains all the possible distinct four-colour pieces.

Bendominoes: Dominoes with a twist!

A less unusual domino game, *Bendominoes* has its own unusual twist, literally.

Bendominoes is a table top strategy game designed by Thierry Denoual, and published by Blue Orange Games (2007). It is packaged in a sturdy tin, which is, cutely, in the shape of a large *Bendomino*. Between 2 and 4 players can engage with this game which involves developing skills in strategy, visualisation, and arithmetic.

Figure 6. Bendomino set.

Playing pieces consist of solid plastic pieces. The basic idea is that each piece is a standard double-6 domino, bent, literally, in an arc.

The arc is designed as a 120-degree curve which introduces a new level of strategy to the game.

Geometrically, each piece is made of two distorted squares. The distortion is, geometrically, an annular sector of a circle, like the wider end of a pizza slice. This means that as play proceeds, in the usual dominoes way, successive ends can match and zig-zag, as a bend-right piece is matched against a bend-left piece, and is then matched by a bend-left piece, and then a bend-right piece. This pattern is repeated as play proceeds between players.

Played this way, the game is identical to standard dominoes. However, if successive bend-right pieces are played, the line of dominoes curves around in a circular way until the end is either blocked off, or comes full-circle if the ends match in the usual way.

The result, overall, is, literally, a twisted version of standard dominoes.

Consequently, *Bendominoes* is *not* very different from standard dominoes, and more of a novelty than a new game. But it is pleasant enough as a small departure from the great classic dominoes game.

A mathematically interesting challenge is to find ways that some, or all, of a *Bendominoes* set can be combined to form a closed loop. Try it!

Variations

For younger players, a version of the game is available that uses pictures instead of numbers and symbols on the tiles.

For the older player, variations in the rules of play (The Bendominoes.com Team, 2015) could include some, or all, of the following:

Wild draw

For a more aggressive game, when players do not have a playable piece they must continue to draw until they get a playable piece or until the stock is empty.

No draw

When players do not have a matching piece, they pass their turn instead of drawing.

No draw – 2 teams of 2 players

In this version, each player draws seven pieces at the start of the game, so there are no left over game pieces. Players take turns and only use their individual pieces. A team wins a round when one team member is declared the winner (see basic rules). The winning team scores the dot points from the remaining Bendominoes of the losing team.

References

The Bendominoes.com Team. (2015). *Bendominoes Rules.* Retrieved 1 May 2015 from http://www.bendominoes. com/bendominoes-rules.php